

FINAL REPORT

South Carolina State Wildlife Grant F11AF00686 (T-56-R)

South Carolina Department of Natural Resources

October 1, 2010 – September 30, 2015

Project Title: Continued monitoring of recently established crab trap-based oyster reefs to document their values as essential fish habitat for a diverse fauna in South Carolina.

NOTE: This report only covers the time period October 1, 2014 – September 30, 2015.

Principal Investigator: Dr. Peter Kingsley-Smith, SCDNR Associate Marine Scientist

Co-Principal Investigator: Benjamin Stone, SCDNR Wildlife Biologist II

Project Collaborators: Bears Bluff National Fish Hatchery
Commercial blue crab fishers
Community volunteers / General public

Objective: To utilize a prevalent form of marine debris (abandoned crab traps) as a viable substrate to create essential finfish habitat that supports multiple priority species of conservation concern, while engaging the public in natural resource stewardship and habitat protection.

Accomplishments:

1) *Crab trap collection*

A total of 288 crab traps were collected through a combination of removals from the environment by South Carolina Department of Natural Resources staff (n=119), and donations from commercial crabbers (n=96), the general public (n=72), and The Nature Conservancy (n=1). These crab traps were used as oyster reef-building substrate (see section 2 below for more details), a more productive fate than causing “ghost fish mortality” of both target and non-target finfish and invertebrate species if left in the environment. Instead, they were used to create oyster reefs like the one in the Ashley River constructed in the summer of 2015.

2) *Online crab trap reporting*

The SCDNR crab trap website (<http://www.dnr.sc.gov/marine/crabtraps/index.html>) was updated by removing the previous online survey that had a total of 79 participants (one of which was completed in 2015 after the survey had been removed from the website, but the survey still seems to be active). The online survey was replaced and website redone to encourage people to download and use the free Marine Debris Tracker smartphone application created by NOAA’s Marine Debris Program (<http://marinedebris.noaa.gov/>). NOAA has its own online database of marine debris reported globally that can be easily shared especially if the users log in with the information supplied on the crab trap website. Those without smartphones could still e-mail us information about abandoned traps at crabtraps@dnr.sc.gov. Updated flyers were also made to inform the public about the need to report abandoned crab traps along with a link and QR codes to download the Marine Debris Tracker smartphone application. These flyers were placed in the windows of bait and tackle shops, boat ramps, and other places where boaters and fishermen frequent. The abandoned crab trap flyer was also placed in the Palmetto Sportsmen’s Classic (<http://www.dnr.sc.gov/psc/>) program to help advertise it. Unfortunately, only 5 abandoned crab

traps were reported using the Marine Debris Tracker smartphone application. There were some inquiries about abandoned crab traps through the crabtraps@dnr.sc.gov e-mail, but the e-mail ended up being used as a means to ask anything crab trap or crab fishing related. A presentation on abandoned crab traps was given to the Sea Coast Anglers fishing club in North Myrtle Beach on April 20, 2015 and the project was also presented at many informal educational opportunities. There was a lot of interest from the public in the removal of these abandoned traps, but the reporting process may still be too time consuming or tedious for the local community given the lack of participation. Low use of this reporting method may have also been due to SCDNR website issues that did not allow the public to access the website for a prolonged period of time.

3) *Crab trap reef construction*

One hundred cement coated crab traps were used to create an oyster reef in the Ashley River on June 29 and 30, 2015 (see Figure 1). This reef was built in collaboration with a NOAA Marine Debris removal grant in Charleston Harbor and was intended to create a footprint similar in size to that of two abandoned vessels that were scheduled to be removed. Each cement coated crab trap was staked down with two pieces of rebar so that it would stay in place and “Danger -- Obstruction” signs were placed at each end of the reef and at the reef’s midpoint to warn boaters. Additional crab traps collected by this grant were also directed towards reef-building efforts in the ACE Basin National Estuarine Research Reserve (NERR) entitled “Expanding living shorelines through stakeholder-driven site selections for intertidal oyster reef building in the ACE Basin NERR, South Carolina,” funded by a NOAA grant to the NERRS Science Collaborative funding opportunity. Some of these additional recovered and donated crab traps were directed towards the construction of a similar reef at the Port Royal Maritime Center on Lemon Island. This crab trap-based reef was constructed adjacent to other new reefs constructed using oyster shell bags, a technique developed by the SCDNR’s South Carolina Oyster Restoration and Enhancement (SCORE) Program, as well as oyster castles (an Allied Concrete Inc. product), with the help of approximately 130 volunteers on May 16, 2015. The oyster reefs created through the funding from both of these grants will generate essential fish habitat (EFH) for a high diversity of species, many of which are federally-managed and of commercial, recreational and ecological importance. More details of such species utilizing these reefs as habitat is provided in the next section.

4) *Finfish sampling and shorebird surveys as a metrics of reef habitat value*

As part of this grant, monthly finfish sampling was conducted for a crab trap reef constructed at the Fort Johnson site (see Figure 2) in May 2012 using FY2012 State Wildlife Grant Program funding that augmented the footprint of a reef constructed in May 2011 with NOAA Federal funds distributed through a Southeast Aquatic Resources Partnership competitive grant. This sampling occurred from October 2014 until September 2015 using the “drop-net technique” developed by College of Charleston Marine Biology graduate student Ryan Joyce (and described in Kingsley-Smith *et al.* 2012). The other two sites (see Figure 2) were no longer suitable for drop net sampling due to high wave energy from heavy boat traffic (ACE Basin) and accumulation of soft sediments making it too difficult to sample (Bear’s Bluff).

The “drop-net” technique involves constructing a net around the crab trap reef at low tide the day before sampling is to occur. The net is then dropped at high tide the day of sampling where after finfish and invertebrates are sampled using dip nets 2-3 hours prior to low tide with the help of volunteers (Figures 3A& 3B) until the tide has reached its maximum ebb. Sampling occurred

concurrently on both the reef plot as well as on an adjacent control plot lacking reef habitat to enable comparisons to be made in terms of associated nektonic faunal assemblages to draw conclusions as to the habitat value of this crab trap-based oyster reef. A list of the finfish and invertebrate species collected by these sampling efforts is shown in Table 1.

A total of 47 taxa were collected and identified, 44 of which were identified to the species level. Twenty-one species were captured at both the reef and control plots, only one of which was captured in the same quantities (Atlantic spadefish). Sixteen species were collected within only the reef plot, and 10 species were collected within only the control plot. Paired t-tests were performed for all species that were collected on more than one occasion, comparing the number of specimens collected in the control vs. the reef plots. For data pooled across all seasons, blue crabs ($p=0.03$) and grass shrimp ($p=0.05$) were found to occur in greater numbers within the reef plots. Other species were found in greater numbers in either the reef or control plot, but none of these differences were statistically significant.

In addition to drop net sampling, shorebird surveys were performed at the Fort Johnson, Bear's Bluff, and ACE Basin crab trap reef sites (Figure 2) from December 2013 through September 2015, with the help of volunteers. These surveys used a combination of digital video cameras, spotting scopes, and binoculars to document the diversity and abundances of shorebirds at the crab trap reef plots, adjacent control plots, and natural oyster reefs to determine whether shorebirds had a preference for one of these types of habitat. All plots covered an area of 5 x 20 meters marked with PVC poles. A blind was used at the Fort Johnson and Bear's Bluff sites so that birds would not be disturbed by the presence of field sampling teams. Surveys were conducted within one hour of low tide approximately monthly at each site usually for a period of 1-3 hours. Shorebirds were identified to species level whenever possible and their behavior (usually foraging) was documented.

A total of 9 different shorebird species were observed (including the snowy egret shown in Figure 4) across the three study sites and three treatments (crab trap reef, control plot, natural reef). Many of the species observed are listed as species of conservation concern by SC's State Wildlife Action Plan (see Table 3). On average, 1.03 shorebirds were observed on the reef plots, 0.56 shorebirds were observed on the control plots, and 1.39 shorebirds were observed on the natural reefs. For the three sites combined, there was no statistical difference in the abundance of shorebirds observed among the different treatments ($p = 0.37$). There was also no significant difference among the treatments within each site (ACE Basin, $p = 0.84$; Bear's Bluff: $p = 0.27$; Fort Johnson: $p=0.77$). The size of the study area may be too small to create a significant impact on shorebird use of these habitats, and the lack of statistical differences is likely to be strongly influenced by the low numbers of birds observed.

Outreach: The following presentation on this project was presented during the reporting period: *Recovering abandoned crab traps for use as oyster reef substrate in South Carolina, USA.*

Stone, Benjamin W. & Kingsley-Smith, P.R. International Conference on Shellfish Restoration. Charleston, SC. Dec. 11, 2014. Another version of this talk that also included information about other SCDNR oyster restoration projects was presented to the Sea Coast Anglers fishing club in Little River, SC on April 20, 2015.

A total of 19 volunteers donated 80 hours of their time assisting with drop net sampling, shorebird surveys, and crab trap reef site visits. These volunteers were all informally educated on this project and about oyster restoration in South Carolina.

T-56-R Final Report

Literature Cited:

Kingsley-Smith, P.R., R.E. Joyce, S.A. Arnott, W.A. Roumillat, C.J. McDonough & M.J.M. Reichert. 2012. Habitat use of intertidal Eastern oyster (*Crassostrea virginica*) reefs by nekton in South Carolina estuaries. *Journal of Shellfish Research* 31:1009-1021.

Federal Cost: \$35,351

Recommendation: Close the grant.

TABLES

Table 1. Abundance of nektonic organisms collected in drop net samples between October 2014 and September 2015, listed alphabetically by species within each family. The * denotes that the species is listed as a marine priority species in the current SC State Wildlife Action Plan.

Phylum	Class	Family	Species	Common Name	Fort Johnson		
					Control	Reef	TOTAL
Arthropoda	Malacostraca	Alpheidae	<i>Alpheus heterochaelis</i>	Bigclaw snapping shrimp	1		1
		Menippidae	<i>Menippe</i> spp.	Stone crab		1	1
		Palaemonidae	<i>Palaemonetes</i> spp.	Grass shrimp*	217	1,758	1,975
		Panopeidae	<i>Eurypanopeus depressus</i>	Flat back mud crab		1	1
			<i>Panopeus herbstii</i>	Atlantic mud crab*		1	1
		Penaeidae	<i>Farfantepenaeus aztecus</i>	Brown shrimp*	12	17	29
			<i>Litopenaeus setiferus</i>	White shrimp*	253	241	494
		Portunidae	<i>Callinectes sapidus</i>	Blue crab*	11	94	105
			<i>Callinectes similis</i>	Lesser blue crab	19	32	51
			<i>Callinectes</i> spp.		2		2
		Limulidae	<i>Limulus polyphemus</i>	Horseshoe crab*		1	1
Chordata	Actinopterygii	Achiridae	<i>Trinectes maculatus</i>	Hogchoker*	3		3
		Atherinidae	<i>Menidia menidia</i>	Atlantic silverside*	11	26	37
		Batrachoididae	<i>Opsanus tau</i>	Oyster toadfish		2	2
			<i>Selene vomer</i>	Lookdown	1		1
		Bramidae	<i>Brama brama</i>	Atlantic pomfret		2	2
		Carangidae	<i>Chloroscombrus chrysurus</i>	Atlantic bumper*	7	5	12
		Clupeidae	<i>Brevoortia tyrannus</i>	Atlantic menhaden*		1	1
			<i>Opisthonema oglinum</i>	Atlantic thread herring		2	2
		Cynoglossidae	<i>Symphurus plagiosa</i>	Blackcheek tonguefish*	6	21	27
		Cyprinodontidae	<i>Fundulus heteroclitus</i>	Mummichog*	3	10	13
			<i>Fundulus majalis</i>	Striped Killifish	18		18
		Dasyatidae	<i>Dasyatis sabina</i>	Atlantic stingray	1		1
		Engraulidae	<i>Anchoa hepsetus</i>	Striped anchovy	6	10	16
			<i>Anchoa mitchilli</i>	Bay anchovy	193	549	742
		Ephippidae	<i>Chaetodipterus faber</i>	Atlantic spadefish*	1	1	2
		Gobiidae	<i>Gobiosoma bosc</i>	Naked goby*	2	9	11
		Gymnuridae	<i>Gymnura micrura</i>	Smooth butterfly ray	1		1
		Haemulidae	<i>Orthopristis chrysoptera</i>	Pigfish	1	2	3
		Lutjanidae	<i>Lutjanus griseus</i>	Grey snapper		4	4
			<i>Mugil cephalus</i>	Striped mullet*	2		2
		Paralichthyidae	<i>Paralichthys dentatus</i>	Summer flounder	10	4	14
			<i>Paralichthys lethostigma</i>	Southern flounder*	1	4	5
		Sciaenidae	<i>Bairdiella chrysoura</i>	Silver perch*	7	43	50
			<i>Cynoscion nothus</i>	Silver seatrout		1	1
			<i>Cynoscion nebulosus</i>	Spotted seatrout	1		1

Table 1. cont'd.

Phylum	Class	Family	Species	Common Name	Fort Johnson		
					Cntrl	Reef	TOTAL
Chordata	Actinopterygii	Sciaenidae	<i>Leiostomus xanthurus</i>	Spot*	43	19	62
			<i>Menticirrhus americanus</i>	Southern kingfish*	12	3	15
			<i>Menticirrhus saxatilis</i>	Northern kingfish	1		1
			<i>Micropogonias undulatus</i>	Atlantic croaker*		4	4
			<i>Pogonias cromis</i>	Black drum*		1	1
		Sparidae	<i>Stellifer lanceolatus</i>	Star drum		25	25
			<i>Archosargus probatocephalus</i>	Sheepshead*		15	15
			<i>Lagodon rhomboides</i>	Pinfish	2	35	37
			Stromateidae	<i>Peprilus paru</i>	American harvestfish		3
		Triglidae		<i>Prionotus tribulus</i>	Bighead searobin		1
Mollusca	Cephalopoda	Loliginidae	<i>Lolliguncula brevis</i>	Atlantic brief squid*	2	4	6
TOTAL					850	2,952	3,802

Table 2. Table of shorebirds observed in the control (C), natural reef (NR), and crab trap reef (TR) plots across all three study sites for this reporting period. The * denotes that this species is listed as a species of conservation concern by the State Wildlife Action Plan.

Family	Species	Common Name	ACE Basin			Bears Bluff			Fort Johnson		
			C	NR	TR	C	NR	TR	C	NR	TR
Ardeidae	<i>Ardea alba</i>	Great egret*				2			2		1
	<i>Ardea herodias</i>	Great blue heron*				1					
	<i>Egretta thula</i>	Snowy egret*				2	2	3	1		2
	<i>Egretta tricolor</i>	Tricolored heron*				1	1	1			
	<i>Egretta</i> spp.					1					
Charadiidae	<i>Charadrius semipalmatus</i>	Semipalmated plover*									1
Scolopacidae	<i>Actitis macularius</i>	Spotted sandpiper*							5		2
	<i>Arenaria interpres</i>	Ruddy turnstone*							2		2
	<i>Calidris alpina</i>	Dunlin*	1		1				5		
	<i>Tringa semipalmata</i>	Willet	2	2	3	1	10	5		3	3
Total			3	2	4	4	17	9	6	12	11

FIGURES



Figure 1. A portion of the new cement coated crab trap reef constructed in the Ashley River and completed on June 30, 2015. One of the “Danger -- Obstruction” signs can be seen on the right.

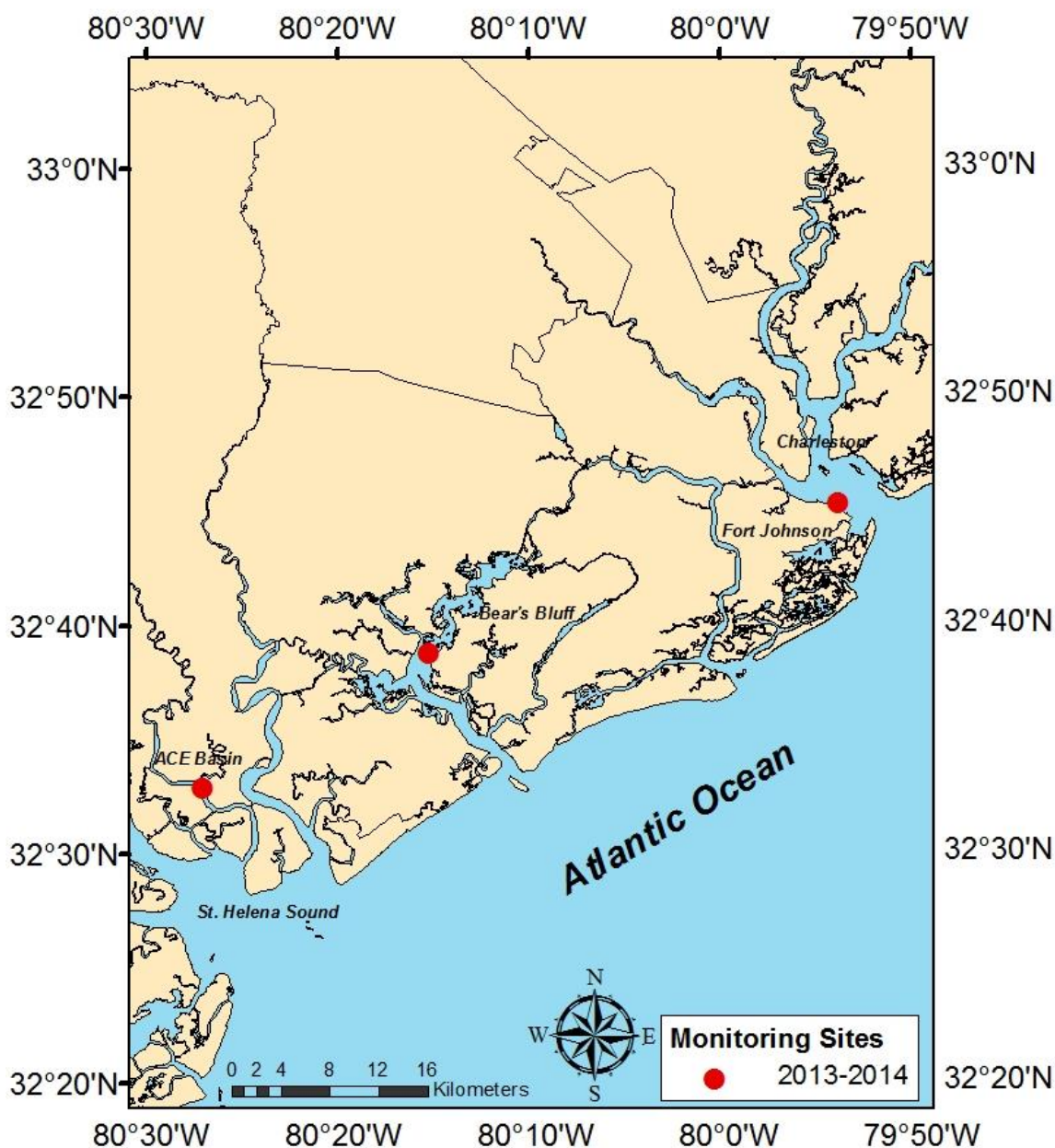


Figure 2. Locations of drop-net sampling and shorebird survey sites, based upon sites established in May 2011 through a NOAA grant coordinated by the Southeast Aquatic Resources Partnership (SARP), and further augmented in May 2012 through SWG funding. The ACE Basin site was only used for shorebird surveys after the first drop net sampling attempt. The Bear's Bluff site was only used for shorebird surveys after November 2013 when the site became too soft for drop net sampling.



Figure 3. A. (*Above*) Drop-net sampling of the Fort Johnson reef site conducted at low tide with the help of volunteers October 7th 2014. B. (*Below*) Volunteers measuring nekton samples and recording data.





Figure 4. Snowy egret (*Egretta thula*) foraging on the crab trap reef plot at the Bear's Bluff site.